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10/644,162	08/20/2003	Stephen M. Trimberger	X-1393 US	5769

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EXAMINER	
WONG, LUT	

ART UNIT	PAPER NUMBER
2129	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/644,162	TRIMBERGER, STEPHEN M.	
	Examiner	Art Unit	
	LUT WONG	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 April 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This office action is responsive to an AMENDMENT entered April 09, 2008 for the patent application 10/644162.

Status of Claims

Claims 1-33 are pending.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 5-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Sverre Vigander ("Evolutionary Fault Repair of Electronics in Space Applications" University of Sussex, Feb 2001). Examiner Notes (EN) and related citations are denoted in parenthesis.

Claim 1: Sverrre anticipates a method for operating a system having a population of designs, each design being adaptable for use in operating the system (See e.g. Introduction on fault tolerant system using GA and FPGAs), the method comprising: in response to an input signal, for each design in the population, generating an associated result signal (See e.g. pg. Fig 6.1 on each designs, inputs and outputs); determining a consensus result as a function of at least two of the generated result

signals (See e.g. pg. Fig 6.1 on voting evaluation. *EN: majority voting scheme is described in applicant's spec [0019] and [0025] as an approach for determining consensus result*); determining an associated fitness level of each design as a function of the associated result signal and the consensus result (*EN: the "fitness" is described in applicant's spec [0019] as "simple agreement of an output of a particular design with outputs from the majority of the designs."* See e.g. Fig 6.1 on *voting evaluation. See also section 6.1*); selecting for replacement at least one design as a function of the associated fitness level (See e.g. pg. Fig 6.2 on *evolving failed units*); evolving a new design from at least one design in the population; and replacing the design selected for replacement with the new design (See e.g. pg. Fig 6.2 on *evolving failed units*).

Claim 2: See e.g. Fig. 6.1 on weighting (*EN: each circuits gets an equal weight in simple majority voting scheme*).

Claim 5: Note that the determining a consensus result includes accumulating result signals from each of the designs over a period of time (See e.g. *section 6.1 on re-evaluating a chip before evolution is applied. EN: this implied the output signals are accumulated at least once*).

Claim 6: Note that the determining a consensus result includes determining a statistical result of the at least two of the generated result signals (See e.g. Fig 6.1 on *voting evaluation. See also section 6.1. EN: majority voting is a "statistical" result (i.e. the mode)).*

Claim 7: Note that the consensus result is outputted (See e.g. Fig 6.1 on *"correct outputs").*

Claim 8: Note that the method further comprising selecting at least one of the designs to generate an output for use in operating the system (See e.g. Fig 6. *EN: the "correct outputs" must be selected from "at least one" of the circuits).*

Claim 9: Note that the determining includes comparing the associated result signal with the consensus result (See e.g. *section 6.1 on majority voting. EN: each circuit's output is compared with the consensus (i.e. majority) in majority voting).*

Claim 10: Note that the fitness level of each design includes determining the associated fitness level as a function of first and second differences, the first difference being a difference between the associated result signal of the design and the consensus result, the second difference being a difference between the associated result signals of the other designs and the consensus result (See e.g. *section 6.1 on majority voting. EN: each circuit's output is compared with the consensus (i.e. majority) in majority voting, and the one disagrees with the others (i.e. majority) is assigned "low" fitness (i.e. being a faulty circuit)).*

Claim 11: Note that the fitness level is determined by a bitwise difference of the signals (*EN: it is inherent because all data are represented as bits/byte in computer. Hence, the comparisons are "bitwise"*).

Claim 12: Note that selecting for replacement at least one design comprises selecting a design having the greatest difference between the associated result signal of the design and the consensus result (See e.g. *section 6.1 on majority voting. EN: faulty circuit is the one with the greatest difference between the consensus (i.e. disagree most with the majority)*).

Claim 13: Note that selecting for replacement the at least one design is a output difference between the signal and the consensus (See e.g. *section 6.1 and Fig 6.1 on majority voting. EN: The faulty circuit is the one being replaced (i.e. the module being shut down by control signals)*).

Claim 14: Note that selecting for replacement the at least one design comprises randomly selecting at least one design (See e.g. section 7.1.7 on equal probability of being as "the elite". *EN: equal probability = random. See definition from answers.com*).

Claim 15: Note that selecting at least one design comprises using the associated fitness as a bias to increases a probability of selecting each design (See e.g. section 7.1.7 on "to lessen the chance of being caught in local optima").

Claim 16: Note that the fitness evaluation includes weighting the design as a function of degree of agreement between the signal and the consensus (See e.g. *section 6.1 on majority voting. EN: each circuit's output is compared with the consensus (i.e. majority) in majority voting, and the one disagrees with the others (i.e. majority) is assigned "low" fitness (i.e. being a faulty circuit)*).

Claim 17: Note that prior to generating an associated result signal, further comprising: evolving a preliminary population of designs by determining an associated fitness level of each design in the preliminary population as a function of fixed evaluation criteria; and in response to satisfaction of selected completion criteria, ceasing evolving the preliminary population of designs and storing the preliminary population of designs as said population of designs from which the associated result signals are generated (See e.g. Section 7 on *experiment setup and initialization*).

Claim 18: note that each of the steps of the method are performed subsequent to an occurrence of at least one of: reaching a selected time; reaching an end of a predetermined time interval; and a triggering event (See e.g. Fig. 7.3 and Experiment 2 *that each run is done with a different, random stuck-at fault (i.e. "triggering event")*).

Claim 19: note that the triggering event is a failure of the system (See e.g. Fig. 7.3 and Experiment 2 *that the triggering event is a random stuck-at fault).*

Claim 20: note that the generating the associated result signal for each design in the population comprises: programming a programmable device with a first design of the population of designs (See e.g. section 7 on experiment setup); reprogramming the programmable device with a second design of the population of designs (See e.g. Fig. 7.3, and experiment 2.1) ; and generating an associated result signal by generating an associated result signal using the second design (See e.g. Fig. 7.3, and experiment 2.1 on the result obtained for the voting system with imperfect FPGAs).

Claim 21: drawn to claim 1. See rejection above.

Claim 22: Note that the consensus result are a function of associated fitness characteristics of the plurality of designs (See e.g. Fig 6.1 on *voting evaluation. See also section 6.1. EN: majority voting means the "concensus" is based on the outputs of plurality (majority) of designs).*

Claim 23: Note that the consensus result includes assigning weight to each of the associated result signals (*EN: each circuits gets an equal weight in simple majority voting scheme*).

Claim 24: the method of claim 21, further comprising: evolving a replacement design using at least two of the hardware designs in the population; evaluating a fitness of the replacement hardware design as a function of the consensus result; repeating the steps of evolving and evaluating until the replacement hardware design produces a result signal that is within a selected range of the consensus result; and wherein selecting and replacing one of the hardware designs in the population with a new design includes replacing one of the hardware designs in the population with the replacement hardware design that produces the result signal that is within the selected range of the consensus result (See e.g. experiment 2 and 2.1 on evolving the faulty FPGA).

Claim 25: Sverrre anticipates a system comprising: a programmable device programmable with at least one of a plurality of designs (See e.g. Fig. 71 on FPGA), each design being adapted to generate an associated result signal in response to an input signal (See e.g. Fig. 71 on FPGA); a fitness evaluator to determine a consensus result as a function of associated result signals from at least two of the plurality of designs and to determine an associated fitness level of each design of the plurality as a function of the associated result signals and the consensus result (See e.g. Fig. 6 on voter); and a selector to select and replace one of the plurality of designs with a new design as a function of the associated fitness level of the selected design (See e.g. Fig. 6 on Voter. See also section 6.2 that the voting system selects a faulty FPGA for evolution).

Claim 26: The system of claim 25, further comprising: an evolution controller to generate the new design from a plurality of the designs (See e.g. section 7.1.6 on evolving new design (i.e. genetic operators)).

Claim 27: The system of claim 25, wherein the fitness evaluator selects at least one of the plurality of designs for implementation in an operational device as a function of the associated fitness levels of the plurality of designs (See e.g. section 7.1.5 on selection method. *EN: the selected designs are based on the rank (i.e. fitness)*).

Claim 28: The system of claim 25, wherein the fitness evaluator determines an associated fitness level of a design exhibiting a fault, the associated fitness level being indicative of the fault, and wherein the selector selects and replaces the design exhibiting the fault as a function of said design's associated fitness level (See e.g. section 6.2. *EN: the voter selects a faulty unit (i.e. disagrees with the majority) to undergo evolution process*).

Claim 29: The system of claim 25, further comprising: a program controller to sequentially program the programmable device with one design at a time, the input signal being sequentially applied to single designs to generate the associated result signals (See e.g. Fig. 8.6. *EN: since the fitness of each individual FPGA is obtained, the input signals must have been applied to each FPGA one at a time (i.e. "sequentially") In other words, unless the results are reported simultaneously, it is being "sequentially"*).

Claim 30: The system of claim 25, wherein the programmable device includes a programmable logic device (See e.g. Fig. 7.1 on FPGA).

Claim 31: The system of claim 25, wherein the programmable device includes a microprocessor (See e.g. Fig. 7.1 on FPGA. *EN: FPGA is a "microprocessor" because it process inputs and generates outputs based on the inputs*).

Claim 32: The system of claim 25, wherein the programmable device includes at least one of the fitness evaluator and the selector (See e.g. Fig. 6.1 on *"selector"/"evaluator" (i.e. the voter)*).

Claim 33: The system of claim 25, further comprising a memory for storing at least one of the plurality of designs (See e.g. Fig 7.1. *EN: each FPGA has a "memory"*).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sverre Vigander ("Evolutionary Fault Repair of Electronics in Space Applications"

University of Sussex, Feb 2001), in view of Xin Yao ("Making Use of Population Information in Evolutionary Arftifical Neural Networks" IEEE 1998).

Claim 3: Sverre teaches a simple voting scheme which weights each individual equally. Sverre fails to teach weighting individual as a function of fitness level determined in a prior generation. In other words, Sverre fails to teach giving more weight to someone that is more "reliable" based on their fitness obtained in a prior generation. However, such idea is nothing more than a weighted voting scheme, in which the weight is not equally distributed. The weight in weighted voting scheme is dynamic, which means a more reliable individual gets more weights than a less reliable one. And, reliability usually determines based on fitness, rank, error measures...etc. Xin teaches the idea of weighted voting (See e.g. IV-B, rank based linear combination), which uses the fitness information to compute a weight for each individual. Xin also teaches the simple majority voting and explained the deficiency of simple voting (See e.g. IV-A). Xin also explained because not all individual are equally important, a weighted voting scheme should be better because it takes into accounts the difference among individuals (See e.g. IV-A and B). One of ordinary skill in the art would/could have been motivated to modify Sverre's simple voter in view of Xin's teaching with predictable result of weighting individual as a function of fitness level determined in a prior generation. It is merely applying a known technique to a known device (method, or product) ready for improvement to yield predictable results. See MPEP 2141 III D.

Claim 4: The combinations of Sevrre and Xin (refer herein as SX) teach weighting individual as a function of fitness level determined in a prior generation (See

claim 3 above). However, SX does not teach weighting individual as a function of number of generations in which the associated design has been a member of the population. In other words, SX does not teach giving more weight to a "senior". However, it would have been obvious to one skill in the art that giving more weight to fitter individual is analogous to giving more weight to senior individual. A fitter individual usually performs better and thus should be given more weight; the same applies to a "senior" individual. Hence, one of ordinary skill in the art would/could have been motivated to modify SX teaching with predictable result of weighting individual as a function of "seniority" rather than "fitness level". It is merely a simple substitution of one known element for another to obtain predictable results. See MPEP 2141 III B.

Response to Arguments

Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lut Wong whose telephone number is (571) 270-1123. The examiner can normally be reached on M-F 7:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vincent David can be reached on (571) 272-3080. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Lut Wong/

Patent Examiner, AU 2129

/David R Vincent/

Supervisory Patent Examiner, Art Unit 2129